

24. The method as claimed in claim 23, wherein an oxide film on the surface of said solder is broken to enhance the surface tension when said solder is melted.

25. The method as claimed in claim 22, wherein said vibration is applied ultrasonically through said liquid to said solder bump disposed in said liquid.

26. The method as claimed in claim 25, wherein an oxide film on the surface of said solder bump is broken to enhance the surface tension when said solder bump is melted.--

REMARKS

Claims 1-19 are pending in the application. No claims are allowed. Claim 10 is also objected to. Claims 1-13 are amended to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. New claims 20-26 are added. No new matter is added.

1. Objections

Claim 10 is objected to because the Examiner found that the word "confront" was unclear. Claim 10 is amended to clarify the confusion. Claim 10 is now in condition for allowance.

2. Claim Rejections Under 35 U.S.C. § 112

Claims 1-2 and 11-12 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. Claims 1-2 and 11-12 are amended to overcome this

rejection. Applicant respectfully submits that amended Claims 1-2 and 11-12 are now in a condition for allowance.

3. Claim Rejections Under 35 U.S.C. § 103

Claims 1-19 are rejected under 35 U.S.C. § 103(a) as being unpatentable over JP(I) in view of Sliwa, Jr. and Sherry. Applicant respectfully traverses this rejection. To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation either in the references themselves or in the knowledge generally available to one of ordinary skill in the art to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success and finally, the prior art reference or references when combined must teach or suggest all the claim limitations. MPEP § 2143. Independent claim 1 as amended recites:

A mounting method for joining a device to a substrate using solder, characterized in that the joining of said device and said substrate is performed **while** said device is at least **partially submerged in a liquid**; wherein said device is at least **partially supported by a buoyant force**.

The JP(I) reference discloses “dipping” a semiconductor element and a substrate in a saturated vapor or in a heated inactive solvent. The JP(I) reference discusses the oxidative effect and temperature control goals achieved by dipping the device in the saturated vapor. The saturated vapor eliminates the effects of oxygen but does nothing to support the structure buoyantly, nor does it discuss the problem that the present invention addresses, namely soldering heavy devices to substrates that tend to flatten out the solder bumps used to join them. The semiconductor elements disclosed in the JP(I) reference are necessarily light and, therefore, the

prior art does not even recognize the problem disclosed and solved by the present invention. The liquid claimed in amended independent claim 1 buoyantly supports the device in order to keep from crushing the solder bumps that are used to join it to the substrate. Temperature control is not a concern. The liquid is not heated nor is it vaporized. Indeed, if the liquid of the present invention were vaporized, it would cease to operate since it would no longer support the heavy device.

One skilled in the art attempting to follow the teaching of JP(I) would not be led to buoyantly support heavy devices while positioning and soldering them through the use of solder bumps. The vapor disclosed in the JP(I) reference heats the entire device to a point where the solder melts. It is a temperature regulation teaching and add nothing to the problem solved by the present invention.

Since it is shown that the JP(I) reference does not teach or suggest the claim limitation of being submerged and buoyantly supported by a liquid, it is respectfully proposed that independent claim 1 as amended should be patentable over the JP(I) reference.

Neither the Sliwa, Jr. nor the Sherry reference disclose nor suggest anything about buoyantly supporting a device as it is soldered to a substrate while submerged in a liquid. As a result, neither Sliwa, Jr. nor Sherry overcome the deficiencies in JP(I) noted above.

Likewise, independent claim 10, as amended, also claims that the device is buoyantly supported while submerged in a liquid as it is soldered to a substrate. As discussed *supra*, since the JP(I) reference does not disclose this critical limitation, independent claim 10 as amended is believed to be patentable over the art of record.

Claims 2-9, 20 and 23-24 depend from claim 1 and include all the limitations found therein. These claims recite additional limitations which, in combination with the

limitations of claim 1, are neither disclosed nor suggested in the art of record and are believed to represent patentable subject matter. Similarly, claims 11-19, 21 and 25-26 depend from claim 10 and include all the limitations found therein. Accordingly, these claims are also believed to be directed towards patentable subject matter.

Reconsideration and allowance of the application are earnestly solicited.

The Commissioner is hereby authorized to charge payment of any additional fees associated with this communication or credit any overpayment to Deposit Account No. 15-0700. If the Examiner believes that a telephone conference would be of value, he is requested to call the undersigned counsel at the number listed below.

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Asst. Commissioner for Patents, Washington, D.C. 20231, on June 27, 2000

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